The A.P.B.

APPARAT PROM BLASTING SYSTEM

Version 3.1 Software for Apple DOS 3.3

INTRODUCTION

The A.P.B. system is the most versatile and cost effective PROM programmer on the market. The system will program virtually all of the common 24 pin EPROMs and EEPROMS. Each PROM type is selected by a special personality module that adapts the programmer to the PROM. The following PROMs can be programmed:

Prom type	Prom size bits (bytes)	3 Supply	5 Volt only
EPROM:	4K (512)	2704	
	8K (1024)	2708	2508, 2758
	16K (2048)	2716 (TI)	2516, 2716
	32K (4096)		2532, 2732, 2732A
	64K (8192)		68764
EEPROM:	16K (2048)		2815, 2816

The PROM programmer is a complete package. It includes powerful and easy to use software and personality modules for all of the PROMs listed above with the exception of the 2815 and 2816. The wiring diagram of all of the modules including the 2815/2816 is in the back of this manual; there are no extra modules to buy.

With the unique combination of personality modules and sophisticated software, the PROM programming system will perform many operations impossible with other systems. Here is a list of operations that can be performed:

- Erase EEPROMs
- Verify PROM is erased
- Read PROMs
- Fully or partially copy PROMs, even to different PROM types
- Fully or partially program PROMs, even 2704 and 2708
- Verify programming is correct
- Load or save PROM data to disk
- Program directly from computer memory
- Examine and/or edit working memory
- Preset working memory with any byte or sequence of bytes

The PROM programmer package consists of an interface card that

plugs into one of the Apple][expansion slots, a complete set of personality modules, disk based software for Apple DOS, and instruction manual.

USING THE A.P.B.

Before you proceed with the operation of the A.P.B., it is necessary to make a copy of the disk, as the one supplied is only partially formatted. This can be accomplished by using the FID program to copy the file "APPARAT PROM BLASTER" from the distribution disk to a formatted DOS 3.3 disk. It is also advisable to make some practice runs through the software to familiarize yourself with its operation.

GENERAL

The A.P.B. package consists of three items: the programmer card, a set of personality modules, and disk based software. The personality modules plug into the programmer card and adapt it to the characteristics of the PROM type to be used. PROMs are programmed by inserting them into the zero insertion force socket on the programmer card, selecting and inserting the appropriate personality module, and running the software.

It should be noted that all inputs and outputs of the A.P.B. software are in hexadecimal.

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WARNING!!!

PROMs can be damaged by even small discharges of static electricity. It is recommended that you ground yourself before handling PROMs. This can be easily accomplished by touching the chassis of the Apple power supply.

Never install or remove A.P.B. card with power applied. This can cause damage to the A.P.B. card and your Apple.

Most PROM manufacturers do not specify whether it is allowable to remove or install PROMs into a circut with power applied. Many of our customers change PROMs with power applied routinely, but this practice has been known to cause surges which can damage the A.P.B. card, so we do not recommend it.

A number of our customers have inquired as to why we have not put a power switch on our board as is present on some other PROM blasters. On the other boards we have examined, some use a switch to turn off the programming voltage to the PROM. The A.P.B. does not apply the progamming voltage when not programming, so no such switch is needed. Other boards switch ground or VCC to the PROM, but it is not clear whether this really provides any protection unless the address, data, and control lines of the PROM are tristated. Also, on the 3 supply PROMs, it would require a multiple pole switch to switch all of the supplies to the PROM. While we could in fact have included the switch and circutry needed to implement these features, this would have pushed the price up considerably. We feel that since no other PROM programmers in the price range of the A.P.B. provided what we would consider adequate power-down protection, that the inconvenience of having to power down between PROMs was worth the lower cost.

If you feel you need to have power down capability, it should be noted that for all of the 5 volt only PROMs which can be used with the A.P.B., power can be removed by unplugging the personality module, but this is not recommended.

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Programming a PROM consists of eight steps:

1) Erase (EPROM)
2) Set up programmer
3) Erase (EEPROM)
4) Load data to be blasted
5) Do actual blast
6) Remove PROM

ERASE EPROM

EPROMs are erased by exposing them to ultraviolet light through a transparent (sometimes translucent) window in the middle of the top side. Erasure sets all bytes of the EPROM to hex FF. Ultraviolet EPROM erasers are available from most computer stores. Erasing an EPROM takes from 20 minutes to an hour, depending on the type of EPROM and the intensity of the eraser. To insure complete erasure, follow the manufacturer's instructions.

SET UP PROGRAMMER

With the control lever in the open (upward) position, install the PROM to be programmed in the zero insertion force socket. Be sure that pin one of the PROM is aligned with the index mark on the socket. Lock the PROM into the socket by moving the control lever to the closed (down) position.

Select the proper personality module from the chart below and install it in socket U1. Be sure that the index mark lines up with pin one.

PERSONALITY MODULE TABLE

ROM TYPE	MODULE TO USE
2704, 2708	2708
TI 2716 (3 supply)	2716 (3 voltage)
2508, 2516, Intel 2716, 2758	I2716 (5 volt only)
2532	2532
2732	2732
2732A	2732A (21 volt)
68764	68764
2815, 2816	2816 (Not supplied)

With the power off, install the A.P.B. card into an empty slot in the Apple. You may use any slot but zero. If you are going to be programming several PROMs, install the programmer into a slot that gives clear access to the PROM socket.

BOOT SOFTWARE

Turn the power on and boot your disk containing a copy of the A.P.B. software. Type "BRUN APPARAT PROM BLASTER". This will load and run the software. The software will first ask you which slot your A.P.B. is plugged into. After responding with a number

between 1 and 7 you will be presented with a list of PROM types and the program will ask which type you will be using. If the A.P.B. software should give you an error message at any point after the software is booted, check the following:

Card in wrong slot
PROM in socket backwards
Wrong personality module
Personality module inserted backards
Try erasing for a longer period of time

If these steps fail to correct the problem, the PROM is probably defective, try another one.

ERASE EEPROM

EEPROMs are erased by applying special signals to certain of their pins. If you are using an EEPROM type "E" for erase. The program will ask you for a PROM START OFFSET and a PROM END OFFSET at which times you may simply press <RETURN> to erase the entire EEPROM, or start and end addresses to specify a range of bytes to be erased.

LOAD DATA

The data to be written in the PROM must be loaded into a working array inside the program. To make things flexible, the data can be loaded from several different sources:

from disk file
from another PROM (see Copy section)
directly from memory
from the keyboard

The use of each of these sources of data is described in detail in other sections of the manual. Choose the appropriate method for your application.

DO ACTUAL BLAST

After you have loaded the data and are at the main menu, select "B" for Blast. You will be asked for an ARRAY START OFFSET (default zero). Normally you will just press return to program the PROM from data starting at the beginning of the array. If you wanted to blast the PROM from another address in the array, for instance if you wanted to blast a 2716 from the second half of a data file for a 2732, you can enter the relative address in the array of the first byte you want blasted into PROM. You will next be asked for the PROM START OFFSET and the PROM END OFFSET,

which default to zero and the end of PROM, respectively. Again, you would normally press <RETURN> in response to both questions, however if you only wanted to blast part of the PROM you could specify the start and end of the range you wanted to blast.

After specifying the blast parameters, the program will check to see if the PROM is erased in the range to be blasted. If not, the program will ask you whether you wish to proceed. In general, unless you wanted to blast over the bytes already in the PROM (having a net effect of a logical AND), you should enter "N" and erase the PROM.

At this point the actual blast will begin. The multi pass PROMs (2704, 2708, 68764) require somewhat more time to blast than the single pass types. The software will indicate the start of each pass. The following are approximate programming times for each PROM tyqe:

2816	25 sec
2704, 2508, 2758, 2816	55 sec
2708, 2516, Intel 2716, 2815 . .	1 min 45 sec
TI 2716, 2532, 2732(A), 68764 . .	3 min 25 sec

Once the blast is complete, the contents of the PROM will be compared with the array to verify that data has been correctly programmed into the PROM. If any discrepancies are noted, the program will give you the option to display the addresses and data in question on the screen.

REMOVE PROM

Turn off the Apple !!!!

Then remove the PROM from the card. If you are going to program several PROMs you can leave the card in the slot. If this is the only PROM you are going to blast you may remove the card before removing the PROM. To prolong the life of the slot edge connector, you should minimize insertions and removals from the slot.

COPYING PROMS

Copying a PROM is similar to the programming process described above. The process involves reading the PROM to be copied into memory, then saving the data to disk. Once it is saved, one or more copies can be made as described above.
Here are the steps:

1) Set up the card and install the PROM to be copied. This is described in detail in step two of the programming sequence above.

2) Boot the software and enter the slot and PROM type.

3) Select "R" to read the PROM into the array. You will be prompted for the PROM START OFFSET, the PROM END OFFSET, and the ARRAY START OFFSET. To read the entire PROM into the beginning of the array, just press return in response to each prompt.

4) Now select the "D" option for disk I/O. Select "S" to save the array to disk. Loading and saving data is described in detail in the software section of this manual.

5) Remove the PROM as described in step seven of the programming instructions above.

6) You can now make one or more coqies of the PROM using the normal programming sequence above.

THE WORKING ARRAY

Many of the operations of the A.P.B. package are performed between the A.P.B. card and an area of memory called the working array. The working array is simply memory space set aside by the program to hold PROM data. The working array can be loaded from disk, saved to disk, read from memory, read from PROM, blasted into PROM, and edited.

Sometimes it is necessary to perform operations on the working array not provided by this software, I.E. disassembly, printing, etc. In these cases one can use the "Q" command to exit the software, and then use monitor commands or any other available means to perform the desired operations. The working array is 8K in length and resides from addresses $4000 to $5FFF.

USING THE SOFTWARE

After the software is booted as described in the programming instructions above, and the A.P.B. slot number and PROM type have been entered, the main menu will be displayed and you will be asked to pick a selection:

```
***** MAIN MENU *****

S)  SETUP PROM TYPE OR BLASTER SLOT
C)  CHECK PROM ERASURE OR ERASE EEPROM
R)  READ PROM INTO ARRAY
B)  BLAST PROM FROM ARRAY
V)  VERIFY PROM AGAINST ARRAY
D)  DISK I/O TO/FROM ARRAY
E)  EDIT ARRAY
M)  MOVE MEMORY INTO ARRAY
F)  FILL ARRAY
Q)  QUIT

SELECT OPTION:
```

SETUP PROM TYPE OR BLASTER SLOT

If for any reason you would want to change the PROM type or A.P.B. slot number, you can use this option to do so.

CHECK PROM ERASURE OR ERASE EEPROM

This option will allow you to specify a start and end PROM offset, and will check the PROM for erasure in this range, listing any discrepancies. Most EPROM erasure errors are due to under erasure. When an EPROM is under erased, the data may be temperature sensitive.

When using this option with EEPROMs, you will be asked whether to erase the specified range of addresses. Note that it takes much longer to erase a subrange of the EEPROM than the whole thing, as EEPROMs provide a fast bulk erase mode.

READ PROM INTO ARRAY

After prompting you for a range of PROM addresses and an array start offset, this will read the range of the PROM into the array starting at the specified offset. The data can then be edited, saved to disk, etc.

BLAST PROM FROM ARRAY

This option will prompt you for a range of array addresses and a PROM start offset. It will then proceed to blast bytes from the array range into the PROM starting at the specified offset. The multi-pass PROMs (2704, 2708, 68764) take much more time to blast than the single pass types, so the software will indicate which pass number it is performing. The single pass PROMs program much faster, so no pass information is displayed.

After the blast is completed, an automatic verify is performed. Any discrepancies will be displayed.

VERIFY PROM AGAINST ARRAY

After prompting you for a PROM address range and an array start offset, this option will perform a byte by byte comparison of the PROM and array data. If all bytes are correct the message "GOOD BLAST" will be displayed. Otherwise a list of offending addresses and data bytes will be displayed.

DISK I/O TO/FROM ARRAY

This option will display the following disk I/O submenu, and prompt you to select an option:

```
***** DISK MENU *****

C)  CATALOG DISK
S)  SAVE ARRAY TO DISK
L)  LOAD ARRAY FROM DISK
D)  DELETE FILE
L)  LOCK FILE
U)  UNLOCK FILE
V)  VERIFY FILE
R)  RETURN TO MAIN MENU

SELECT OPTION:
```

CATALOG DISK

This option will prompt you for slot and drive numbers, and display the catalog of the selected drive. This drive becomes the new default for the other disk commands.

SAVE ARRAY TO DISK

This selection will prompt you for a range of array addresses, a file name, and a reload address (default $800). The specified range of array bytes will be written into the file on the default drive. The reload address is written into the file so DOS will have an address to load the file into with its "BLOAD" and "BRUN" commands.

LOAD ARRAY FROM DISK

After specifying a filename and a array start offset, this command will load the file into the array at that offset. The data can then be edited, saved to disk, etc.

DELETE, UNLOCK, LOCK, VERIFY FILE

These commands will prompt for a filename and then delete, unlock, lock, or verify the specified file.

RETURN TO MAIN MENU

Entering this selection will return you to the main menu.

COPY MEMORY INTO ARRAY

This command will allow you to copy data from any part of memory directly into the array by specifying the memory address range and array start offset.

FILL ARRAY

This option will ask you for an array address range, then will allow you to enter from 1 to 16 bytes, After the last byte entered, just press return. The specified series of bytes will then be repeated to fill the array range.

EDIT ARRAY

This option takes you into edit mode. In edit mode the screen will display one full page (256 bytes) of memory at a time in the following format:

XXXX:00112233 44556677 8899AABB CCDDEEFF

where XXXX is the array offset and 00 through FF are data bytes. The current byte will be displayed in inverse. The current byte can be changed by directly entering hex data. After every two hex digits entered the cursor will move to the next byte. The following commands may be used in edit mode:

```
cursor:    up              G)  Go:  prompts for new cursor offset
             I             R)  Return to main menu
       left J   K right
             M
          down             Left arrow:  move cursor one page
                           Right arrow:  move cursor forward one page
```

HARDWARE NOTES

The A.P.B. board has been designed to blast all of the common 24 pin PROMs. Most of the pinouts on these PROMs are identical. The only differences exist on pins 18, 19, 20, 21, and 24. These pins require various voltage levels depending upon the PROM type. These pins are connected to the personality module socket on the card. Other pins on the personality module socket provide special logic levels and voltages needed by the different PROM types. By installing headers with appropriate jumpers, the proper logic levels can be connected to the proper PROM pins for each PROM type.

The following special signals are available at the personality module socket:

A11 Address bit 11, provides most significant address bit for 4K PROMs

A10 Address bit 10, provides most significant address bit for 2K PROMs

PPH Program Pulse High, can be switched between 0, 5, and 26 volts

PPL Program Pulse Low, can be switched between 0, 5, and 12 volts

TTL1 TTL level pulse, can be used for chip select, output enable, etc.

-5V, +5V, +12V Power supply lines

ROM ADDRESSING

The address lines for the PROM are provided by a 12 bit binary counter on the A.P.B. card. This takes the PROM off of the Apple's address bus and allows the programmer to program large PROMs without interfering with the Apple's PROM space. The counter can be reset and incremented under software control.

THE PIA

Interfacing of the A.P.B. card to the Apple bus is provided by a 6821 PIA. The PIA registers are addressed as follows, where X is the A.P.B. slot number plus 8:

Port A	Data Direction Register	$COX0
	Data Port	$COX0
	Control Port	$COX1
Port B	Data Direction Register	$COX2
	Data Port	$COX2
	Control Port	$COX3

Port B of the PIA is connected directly to the data bus of the PROM. Since the port can be programmed as either an inputs or outputs, data can be either read or written to the PROM.

Port A is used to control the address counter and the special personality module logic lines. Each bit of port A is set up as an output and controls the following functions:

Bit:	7	6	5	4	3	2	1	0
	PPH1	PPH0	PPL1	PPL0	TTL1	-	RESET	COUNT

PPH1	PPH0	PPH Voltage
0	0	Ground
0	1	+5
1	0	+26
1	1	Tristate

PPL1	PPL0	PPL Voltage
0	0	Ground
0	1	Ground
1	0	+12
1	1	+5

Bit 3 controls the TTL1 line.
A high pulse on bit 1 resets the address counter.
A high pulse on bit 0 increments the address counter.

The 26 volt programming pulse is provided by a charge pump which converts +12V and -12V into +36V. The +36V supply is regulated down to +26V and fed to the pulse control logic.

APPARAT PROM BLASTING SYSTEM DOCUMENTATION ADDENDUM
SOFTWARE VERSION 3.4 JUNE 2, 1982

This document describes the differences between APB software version 3.1 (as described in the manual) and version 3.4.

I. The APB software is now stored in a modified format binary file with a quick loader. This increases the size of the file slightly, but it will now load via a DOS "BRUN" command approximately twice as fast as the previous version. It should be noted that this prevents copying the file by the DOS "BLOAD" and "BSAVE" commands, however FID and most other generalized file copy programs will copy it properly. The easiest way to backup the software now is to use its own "U" command, as described below.

II. The main menu "D" command and the disk menu have been dropped. In its place are now the "L" (load) and "S" (save) commands of the main menu. These commands function in essentially the same manner as the old disk menu "L" and "S" commands, however the default disk slot and drive are now automatically set to those from which the software was run.

III. The main menu "S" command and the setup menu are now replaced by the main menu "A" (APB slot) and "P" (PROM type) commands. The "A" command will prompt you for a new APB card slot number, and the "P" command will allow you to select one of the ten supported PROM types. The copy of the APB software supplied on the distribution disk is configured to default to APB slot 7 and PROM type 2716 (single supply).

IV. A new command "U" (update) has been added to the main menu. This command will allow you to select disk slot and drive numbers and display the catalog of the disk in the same manner as the "L" and "S" commands. You will then be prompted for a filename. If you specify a filename, the APB software will write itself into the specified binary file. This can be used to backup the APB software. It should also be noted that the default APB slot and PROM type of the software written by the "U" command will be those which were in effect at the time the "U" command was executed. If you use your APB card in slot 2, for example, you would probably find it advantageous to use the "A" command to select slot 2 and then use "U" to rewrite the software to disk. The new copy will then default to slot 2.

V. The "C", "R", "B", and "V" commands (check erasure, read, blast, and verify PROM, respectively) no longer require the input of PROM and array start and end offsets, as partial PROM operations were found to cause problems in certain circumstances. Partial erasure of EEPROMS is not supported in this release. The new procedure for partial blasts is as follows:

1. Use the "R" (read) command to read the former contents of the PROM.

2. Make any desired changes to the array using the "E" (edit) and "L" (load) commands.

3. Reblast the PROM using the "B" command.

In order to prevent prom damage it is important that no bits that were clear (0) in the PROM originally are set (1) in the array when the blast command is used.

VI. The "S" (save) command no longer prompts for a reload address.

VII. The "L" (load) command will now display the length of the specified binary file and give you the option of only loading part of it.

VIII. The "F" (fill) command no longer is limited to 16 byte sequences; indeed, you may enter bytes until you have completely filled the array range you have specified if you so desire.

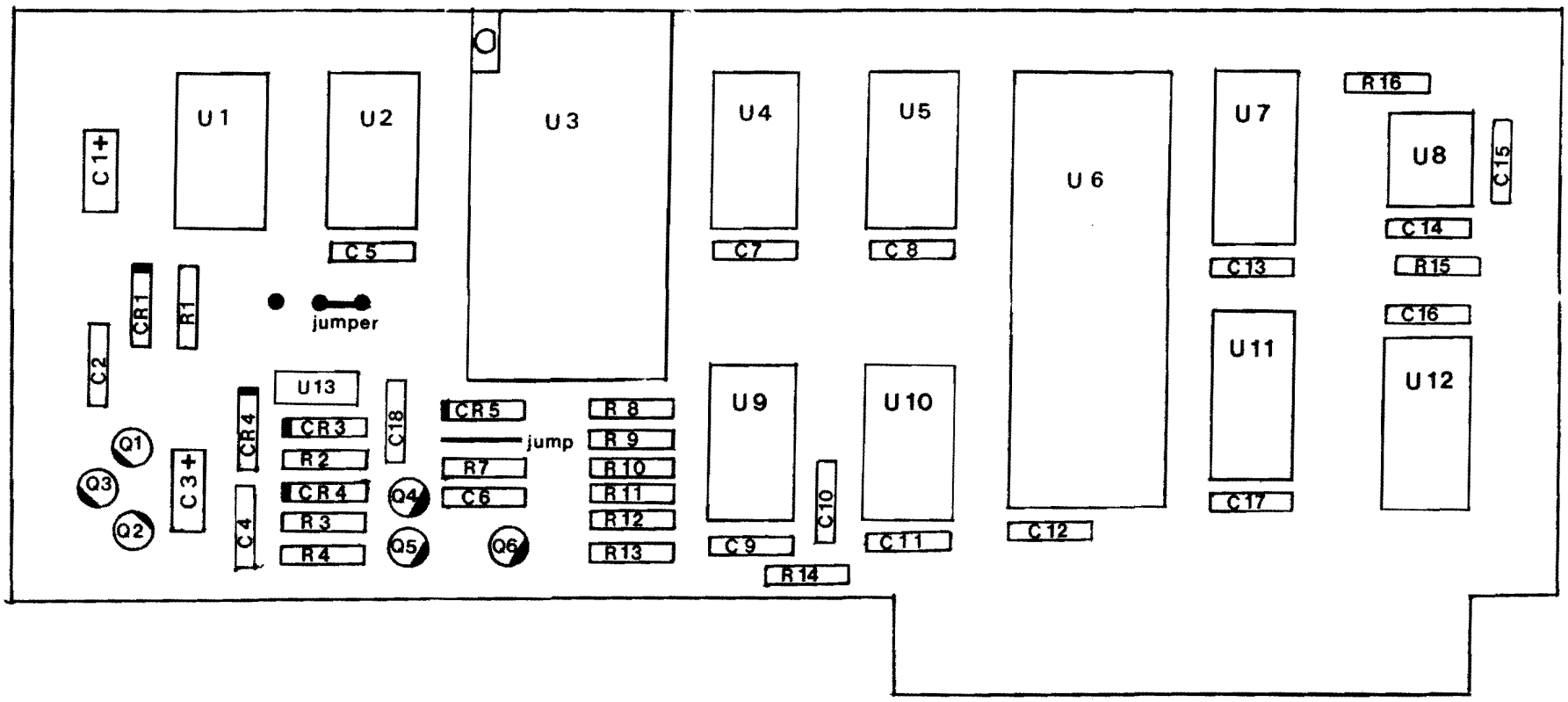
IX. The "E" (edit) command now has two new subcommands: CTRL-B and CTRL-E. These commands move the cursor to the start and end of the array, repectively.

X. The manual neglects to mention at the bottom of page 7 that after using the Apple monitor to work on the array, the CTRL-Y monitor command is used to re-enter the APB software. Also, after entering the monitor with the "Q" (quit) command or by pressing reset, BASIC may be entered by the monitor command "3D0G".

PARTS LIST

U1	Personality Module
U2	4040
U3	ZIF PROM socket
U4	74LS02
U5	74LS04
U6	6520, 6820, or 6821
U7, U11, U12	74LS367
U8	555
U9	7407
U10	74LS00
U13	7824
C1, C3	3.3
C2, C5-C9, C11-C14, C16-C18	.1
C4	.06
C10	.22
C15	.001
R1, R15	1K
R2, R12, R13	10K
R3	10
R4	50
R7	390
R8	6.8K
R9	2.2K
R10, R11	2.7K
R14	1.5M
R16	47K
CR1, CR2, CR4	1N4001
CR3	3.2V Zener
CR5	5V Zener
Q1-Q3, Q6	2N2222 NPN
Q4, Q5	2N2907 PNP

Note: Unless otherwise specified, all capacitances are in Mfd, resistances are in ohms, and all resistors are 1/4 Watt.


U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
C1+
C2
C3+
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
CR1
CR2
CR3
CR4
CR5
R1
R2
R3
R4
R5
R6
R7
R8
R9
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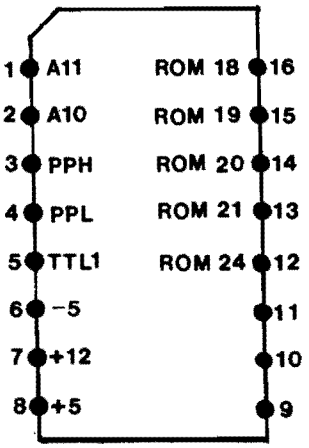
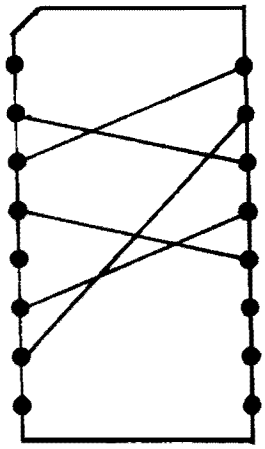
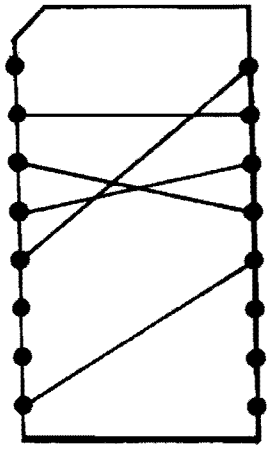
R15
R16
Q1
Q2
Q3
Q4
Q5
Q6
jumper
jump



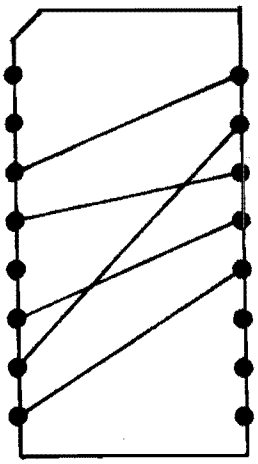
SIGNALS



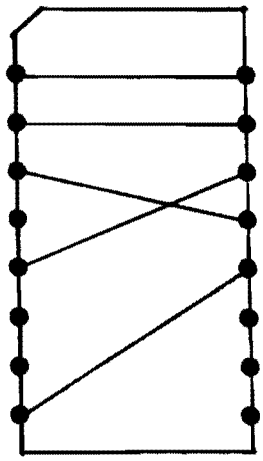
2716
3 Voltage



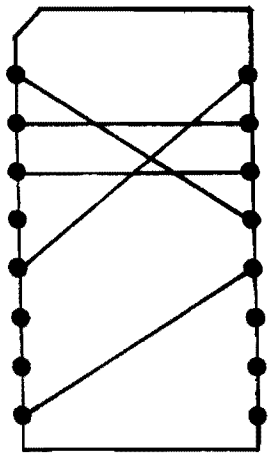
2716
5 Volt Only



2708

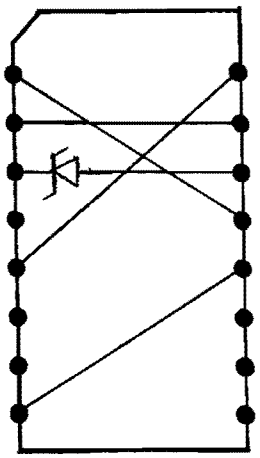


2532

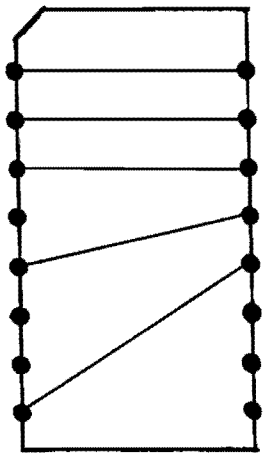


2732

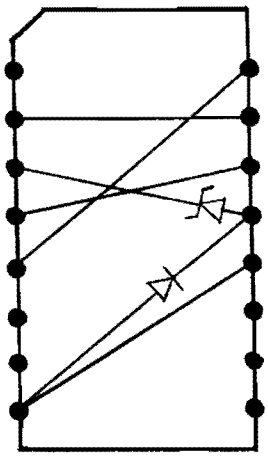
Zeners are 1N5231 Diodes are 1N4001



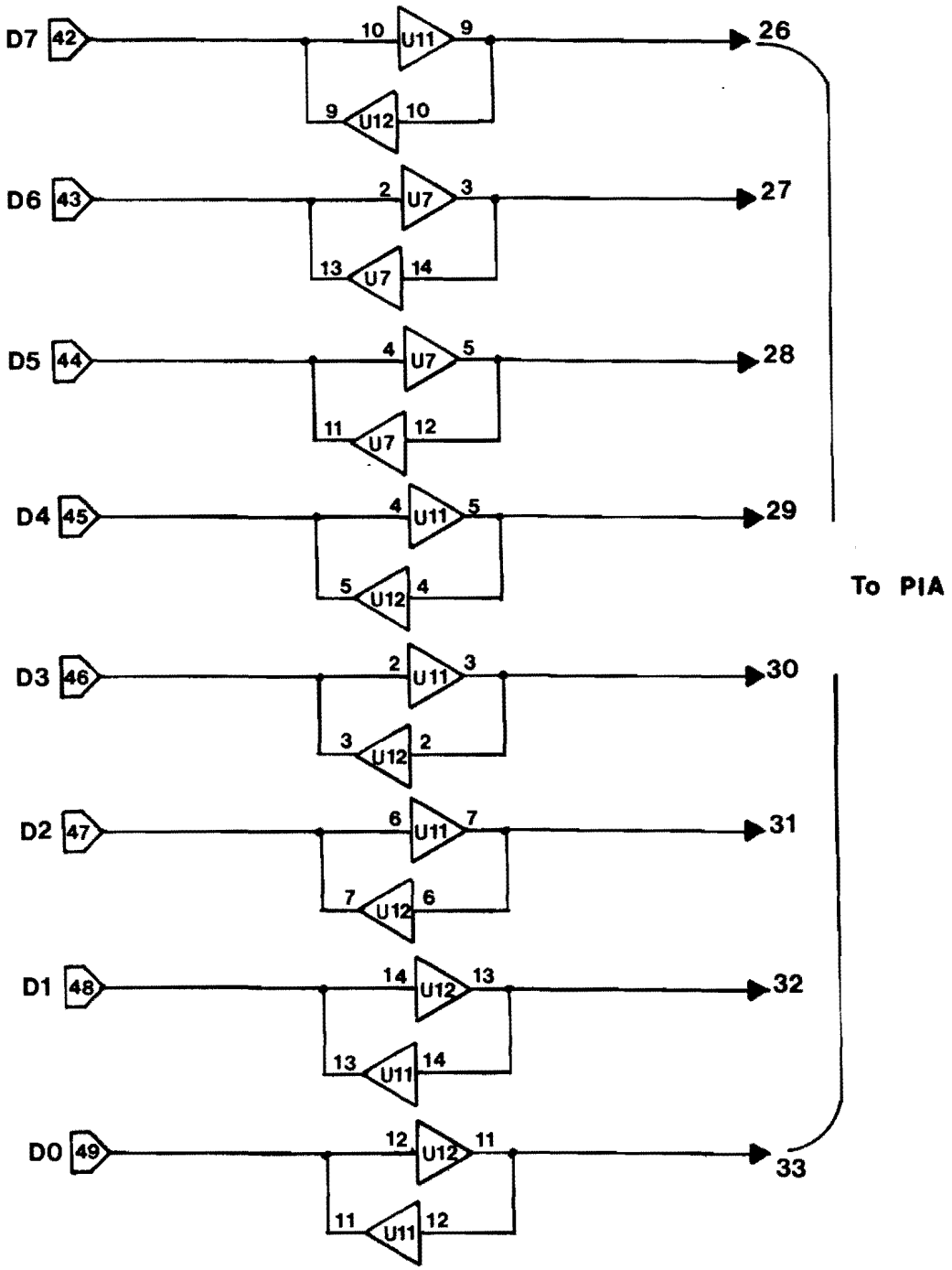
2732A

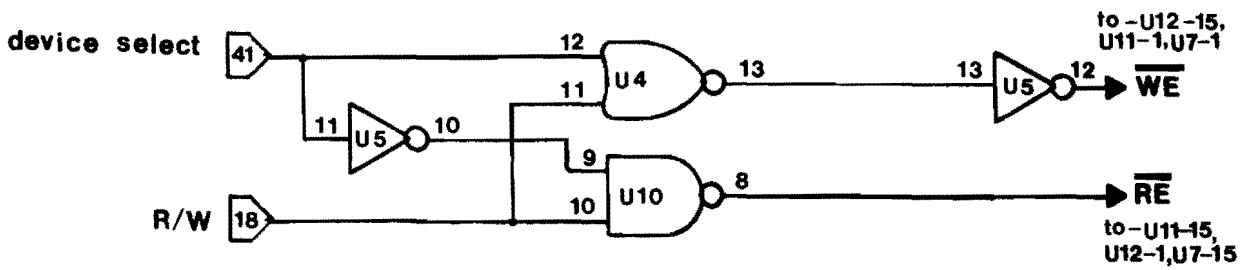


68764

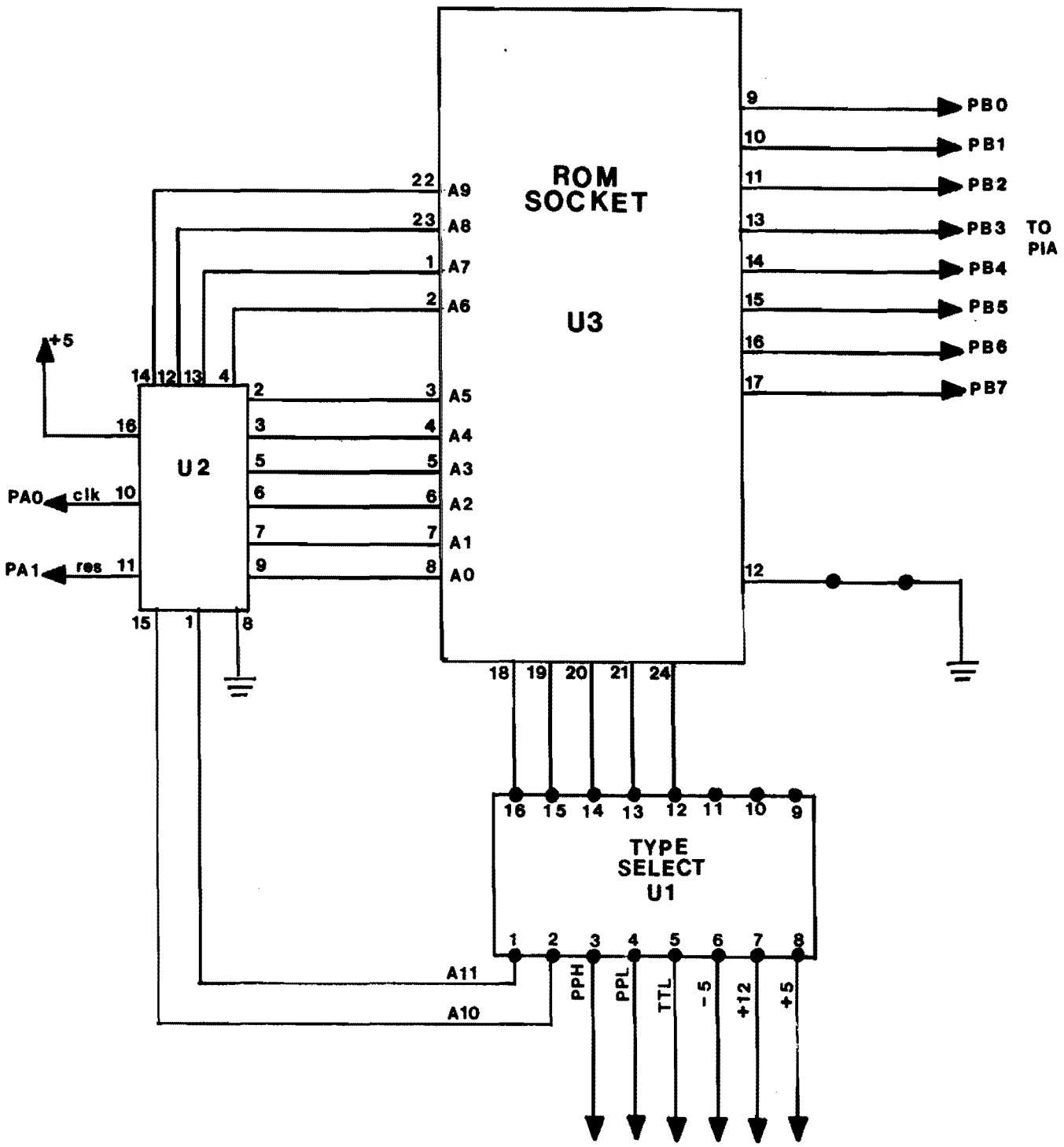


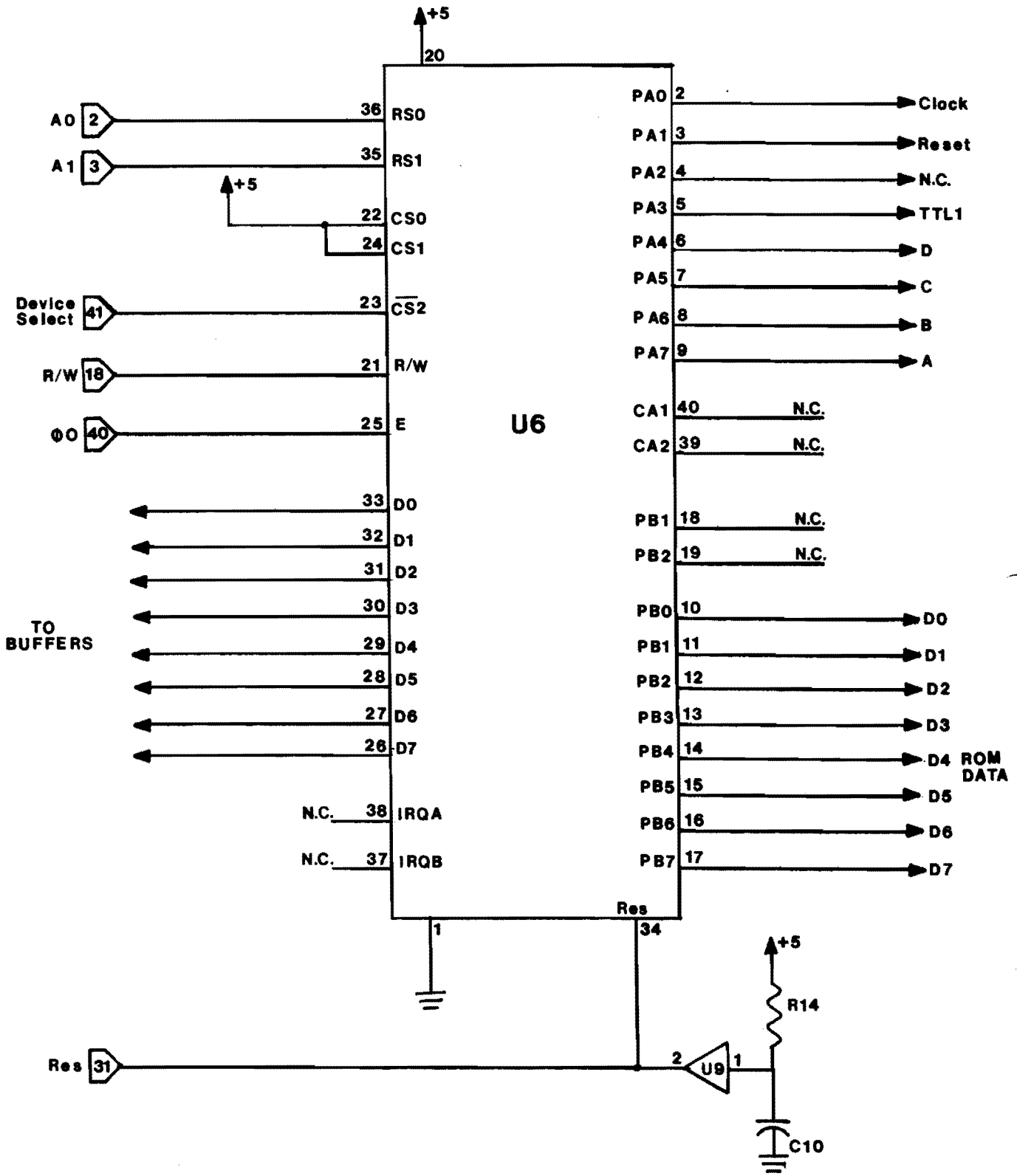
2815/2816

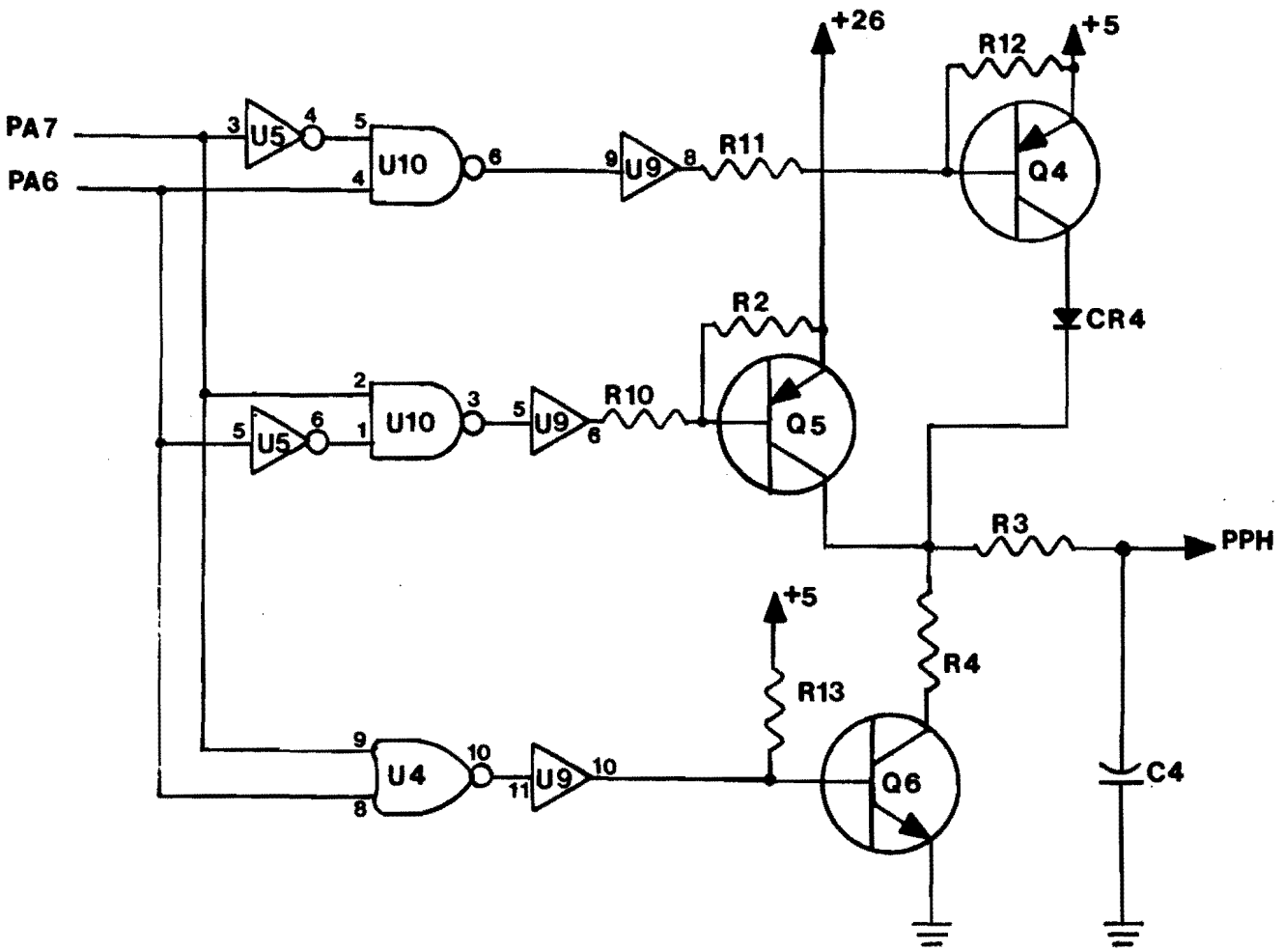

D7
42
10
U11
9
26
9
U12
10
D6
43
2
U7
3
27
13
U7
14
D5
44
4
U7
5
28
11
U7
12
D4
45
4
U11
5
29
5
U12
4
To PIA
D3
46
2
U11
3
30
3
U12
2
D2
47
6
U11
7
31
7
U12
6
D1
48
14
U12
13
32
13
U11
14
D0
49
12
U12
11
33
11
U11
12


device select
41
12
U4
13
13
U5
12
to-U12-15,
U11-1,U7-1
WE
11
U5
10
11
9
U10
8
R/W
18
10
RE
to-U11-15,
U12-1,U7-15

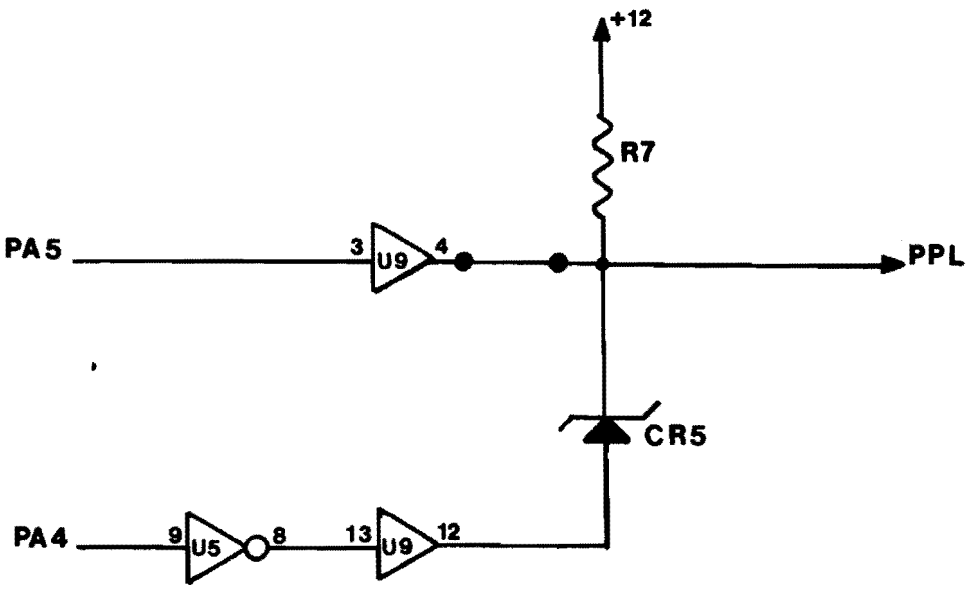
C15
R16
R15
6
2
7
U8
1
8
-12
N.C.
5
4
3
R8
R9
Q3
Q2
Q1
-12
+12
C1
C3
CR2
CR1
+36
U13
CR3
+26


ROM
SOCKET
U3
U2
U1
TYPE
SELECT
+5
PA0
clk
PA1
res
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
A11
A10
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
TO
PIA
PPH
PPL
TTL
-5
+12
+5


+5
20
A0 2
36 RS0
A1 3
35 RS1
+5
22 CS0
24 CS1
Device Select 41
23 CS2
R/W 18
21 R/W
Φ0 40
25 E
U6
33 D0
32 D1
31 D2
30 D3
TO BUFFERS
29 D4
28 D5
27 D6
26 D7
N.C. 38 IRQA
N.C. 37 IRQB
1
Res
34
PA0 2
PA1 3
PA2 4
PA3 5
PA4 6
PA5 7
PA6 8
PA7 9
Clock
Reset
N.C.
TTL1
D
C
B
A
CA1 40 N.C.
CA2 39 N.C.
PB1 18 N.C.
PB2 19 N.C.
PB0 10
PB1 11
PB2 12
PB3 13
PB4 14
PB5 15
PB6 16
PB7 17
D0
D1
D2
D3
D4 ROM DATA
D5
D6
D7
+5
R14
Res 31
2 U9 1
C10



PA-7	PA-6	PPH
O	O	GND
O	I	+5
I	O	+26
I	I	TRI



PA5	PA4	PPL
0	0	0
0	1	0
1	0	12v
1	1	5v